United States Department of the Interior
Bureau of Land Management

BLM

Supplemental Environmental Assessment

DOI-BLM-CO-N040-2020-0061-EA

Analysis of Reasonably Foreseeable Greenhouse Gas Emissions from the Combustion of Federal Oil and Gas

Dual Operator 5-Pad Proposal EA
and
Bull Mountain Unit Master Development Plan EIS

Uncompahgre Field Office
2465 South Townsend Avenue
Montrose, Colorado 81401

Colorado River Valley Field Office
2300 River Frontage Road
Silt, Colorado 81652

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1. INTRODUCTION

1.1 BACKGROUND

In September 2015, the U.S. Bureau of Land Management (BLM) Uncompahgre Field Office (UFO) and U.S. Forest Service Grand Mesa, Uncompahgre and Gunnison National Forests (GMUG) approved two operators' proposals for oil and gas development, described as the Dual Operator 5-Pad Proposal ("5-Pad Proposal" or "5-Pad Project"). In October 2017, the BLM Southwest District Office approved the Bull Mountain Unit Master Development Plan (BMUMDP), a separate oil and gas development project that involves no national forest lands. BLM analyzed the BMUMDP in an Environmental Impact Statement (EIS), DOI-BLM-S050-2013-0022-EIS (BLM 2017b); BLM and the Forest Service jointly analyzed the 5-Pad Proposal in an environmental assessment (EA), DOI-BLM-S050-2015-0029-EA (BLM and USFS 2015).

On March 27, 2019, the U.S. District Court for the District of Colorado issued a memorandum opinion and order in a lawsuit challenging the two decisions, *Citizens for a Healthy Community v. U.S. Bureau of Land Management*, No. 17-cv-2519, upholding most aspects of the agencies' analyses of the impacts of the projects, but concluding that with respect to emissions of greenhouse gases (GHGs) and their associated effects on climate change, BLM and the Forest Service had failed to comply with the National Environmental Policy Act (NEPA) "by not taking a hard look at the foreseeable indirect effects resulting from the combustion of oil and gas" produced by implementation of the two projects.

On December 10, 2019, the court remanded the EIS for the BMUMDP and the EA for the 5-Pad Proposal "for further analysis of the reasonably foreseeable indirect impacts of oil and gas." The court ordered the suspension of approved applications for permits to drill (APDs) for the projects, and enjoined the agencies from approving further project APDs, until they had completed supplemental analysis.[1]

This supplemental EA (DOI-BLM-CO-N040-2020-0061-EA) has been prepared by BLM's Colorado River Valley Field Office on behalf of the UFO.

1.2 LOCATION OF THE BMUMDP AND DUAL OPERATOR 5-PAD PROJECTS

The center of the area encompassed by the two adjacent projects addressed in this EA is approximately 15 miles northeast of Paonia, Colorado. Both projects are located in western Gunnison County. The BMUMDP includes lands east and west of State Highway (SH) 133, north of Paonia Reservoir. The 5-Pad project area lies west of the BMUMDP.

1.3 PURPOSE AND NEED

The purpose of this EA is to analyze the greenhouse gas (GHG) emissions and climate change impacts that may result from the combustion of oil and natural gas produced through operations approved in the Decision Record (DR) for the 5-Pad Project and the Record of Decision (ROD) for the BMUMDP. The need for this action is to address the analytical deficiency identified in the court's memorandum opinion and order dated March 26, 2019, as modified by its Order dated December 10, 2019. BLM will review its prior decisions for the two projects based on the additional analysis contained in this document.

[1] Prior to issuance of the court's memorandum opinion and order in March 2019, BLM had approved APDs for eight Federal wells on four well pads for the 5-Pad Proposal, and APDs for seven Federal wells on four well pads for the BMUMDP. Additional wells were anticipated in the project proposals considered in the EA and EIS, including up to 17 Federal wells on five pads under the 5-Pad Proposal, and up to 139 Federal wells on 33 pads in the BMUMDP.

Accordingly, this EA supplements the analyses of GHG emissions in the EIS and EA described above, with emphasis on GHG emissions resulting from end-use combustion of the produced fluid minerals. This EA, together with the previous BLM EIS for the BMUMDP, and the joint BLM-USFS EA for the 5-Pad Proposal, constitute BLM's NEPA analysis for these two projects. The EIS and EA contain broader statements of purpose and need than the limited issue for which the two NEPA documents were remanded. The original EIS and EA also contain detailed analyses of reasonably foreseeable impacts related to the broader purpose and need statements.

1.4 DECISIONS TO BE MADE

The BLM will decide, based on its evaluation of the reasonably foreseeable GHG emissions from combustion of natural gas, whether to affirm its earlier decisions to approve the 5-Pad Proposal and the BMUMDP.

The GMUG, which is a cooperating agency for this supplemental EA, will respond to the court's order through a separate evaluation of its own decisions in connection with the 5-Pad Project. The BMUMDP involves no National Forest System lands and no project components requiring Forest Service approval.

1.5 ISSUE ANALYZED IN THE EA

The court's directive concerned the agencies' analysis of climate change and GHG emissions-related impacts potentially resulting from the combustion of Federal minerals produced under the 5-Pad Proposal and the BMUMDP. This supplemental EA makes no changes to the descriptions and analyses of resources, resource uses, impacts, and mitigation described in the earlier NEPA documents, except as related to the potential GHG emissions and climate change impacts associated with the combustion of oil and gas produced by the two projects.

1.6 PUBLIC PARTICIPATION

The BLM provided opportunities for public participation in the development of the 5-Pad Proposal EA and the BMUMDP EIS through public scoping and comment periods, as described in those documents. Because this EA has been prepared to address the single issue described in the court's orders, the BLM did not conduct additional public scoping for this analysis.

The BLM is providing a 3-week public comment period for this EA beginning June 30, 2020, by posting the document on BLM's ePlanning web site. Comments should be submitted electronically via ePlanning by close of business on August 20, 2020. Comments received from the public will be reviewed and incorporated, as appropriate, into a revised EA.

2. ALTERNATIVES

2.1 ALTERNATIVES ANALYZED IN DETAIL

2.1.1 Proposed Alternative

Under the Proposed Action, the BLM would affirm its prior decisions to approve the 5-Pad Proposal in September 2015 and the BMUMDP in October 2017, and operations subject to BLM's authority would be expected to resume in the two project areas. BLM's previous decisions for the two projects included general and site-specific conditions of approval (COAs) to mitigate environmental or resource conflicts that may occur in relation to a specific location, facility, or action. Under the proposed action, these COAs would remain in place. BLM's review of pending or future APDs received for either of the two projects would consider the analysis in this EA, the original NEPA document for each project, and any

other pertinent analyses in evaluating the scope and sufficiency of existing analyses at the time each new proposal is received. BLM would prepare further NEPA analysis for subsequent proposals, if appropriate.

The specific proposals of the two projects are incorporated by reference and can be found on pages 19 through 63 of the 5-Pad Proposal EA and pages 2-86 through 2-102 of the BMUMDP EIS.

2.1.2 No Action Alternative

The No Action Alternative would negate BLM's earlier decisions approving the 5-Pad Proposal and the BMUMDP. However, choosing the No Action alternative would not prevent approval of future APDs on the affected Federal leases, subject to analysis in future NEPA documents and consistency with applicable land use planning decisions, lease stipulations, and BLM oil and gas regulations.

Development of other Federal and private minerals also would be expected to continue on adjacent leases, including private wells described as part of the no-action alternative in the EIS for the BMUMDP.

2.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

No other alternatives were considered for this analysis. The No Action Alternative and the Proposed Action allow for sufficient comparison of the impacts associated with the single issue analyzed in this document.

2.3 CONFORMANCE CONSISTENCY REVIEW

The previous decisions for the two projects discussed in this supplemental EA conformed with the BLM plan and were consistent with the Forest Service plan then in effect:

- **BLM Land Use Plan:** Uncompahgre Basin Resource Management Plan (RMP) – Applicable to drilling, completion, and production activities within Federal leases, and off-lease infrastructure on BLM lands. Approved July 1989. Applies to both projects.
- **Forest Service Land Use Plan:** Amended Land and Resource Management Plan (LRMP), Grand Mesa, Uncompahgre and Gunnison National Forests. Applicable to surface disturbance, facilities, and project activities on NFS lands. Approved September 1991. Applies only to the 5-Pad Project.

On April 2, 2020, the BLM signed the UFO Record of Decision and Approved Resource Management Plan (ROD/ARMP), which replaced the 1989 RMP. Although the 2020 ROD/ARMP includes decisions related to stipulations and other restrictions that would apply to future oil and gas leases and their subsequent development, it does not alter fluid mineral leases issued pursuant to prior land use plans. No aspects of the previous BMUMDP and 5-Pad Project approval decisions would conflict with the new RMP. Therefore, the alternatives considered in this supplemental EA are consistent with the current land use plan for the UFO.

Relative to this analysis, Management Action AIR-MA-05 in the 2020 ROD/ARMP states: *Conduct greenhouse gas and climate change analyses (e.g., quantify greenhouse gas emissions and assess potential impacts on climate for proposed actions) consistent with current policy/guidance, while following the overall BLM Colorado Air Resources adaptive management approach for protecting air resources and related values utilizing the most current data/information, trends, and climate modeling studies.* The analysis in this supplemental EA implements this management action.

3. AFFECTED ENVIRONMENT AND EFFECTS

3.1 INTRODUCTION

This chapter describes the present climatic conditions in Colorado and the western U.S., including the effects of climate change, as well as the existing rates of GHG emissions in the vicinity of the two projects and at other relevant scales. This chapter also discusses the reasonably foreseeable GHG emissions potentially resulting from development and combustion of fluid minerals produced by the two projects.

The following analysis uses the terms "upstream" and "midstream" emissions (also referred to collectively as "direct" or "development-related" emissions) and "downstream" emissions from combustion (also referred to as "indirect" emissions) to describe the GHG emissions potentially resulting from the proposed action. Upstream emissions refer primarily to emissions generated during construction of the well pad, access road, pipelines, and other facilities, the drilling and completion of wells, and production phase operations located at the well-pad. Midstream emissions refer to emissions generated during the production phase at centralized processing and storage facilities and transportation of the produced minerals to the final end-use destination. Downstream emissions, which are the focus of this supplemental analysis, are the emissions associated with consumption of oil and gas produced by the projects. Upstream and midstream emissions were described and analyzed in the original EA and EIS for the projects, and those analyses are incorporated by reference where indicated below.

3.2 PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS

In addition to direct and indirect effects, NEPA requires Federal agencies to consider the cumulative effects of proposals under their review. Cumulative effects are defined in the Council on Environmental Quality (CEQ) regulations (40 CFR §1508.7) as "the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency... or person undertakes such other actions." In its guidance, the CEQ has stated that the "cumulative effects analyses should be conducted on the scale of human communities, landscapes, watersheds, or airsheds" using the concept of "project impact zone" (i.e., the area that might be influenced by the Proposed Action).

The cumulative impact analysis of the proposed action includes discussion of total statewide, regional, and nationwide GHG emission levels. Since climate change is a global phenomenon, this section also includes consideration of global climate change and the global carbon budget.

3.3 AFFECTED ENVIRONMENT

3.3.1 Climate and Climate Change

A meteorological station in Redstone, Colorado provides the nearest long-term meteorological measurements (1979 to 1994) representative of the area where the projects are located.[2] The station is located approximately 10 miles northeast of the project area, at an elevation of 8,070 feet above mean sea level (amsl) (Western Regional Climate Center [WRCC] 2017a).

[2] BLM Colorado operates an air quality and meteorological station just south of the two project areas in Paonia, Colorado. This station was established in order to characterize existing air quality conditions in a populated area of the North Fork Valley near the projects. The station will also serve in evaluating conditions as new oil and gas developments in the area proceed. This meteorological station has been in operation for approximately 2 years, which is not enough time to develop climate data representative of the area.

The annual average total precipitation at Redstone, Colorado is 27.7 inches, with annual totals ranging from 20.2 inches (1987) to 40.4 inches (1985). Precipitation is greatest in the spring and fall months. An average of 169.4 inches of snow falls during the year and occurs from fall through spring with the greatest monthly mean snowfall in March, averaging 32.4 inches. The region has cool temperatures, with the average daily temperature (in degrees Fahrenheit [˚F]) ranging between 8˚F and 33˚F in January to between 44˚F and 76˚F in July. The frost-free period generally occurs from early June to mid-September. The closest comprehensive wind measurements were collected at the McClure Pass Colorado Remote Automated Weather Station (RAWS) (WRCC 2017b), located approximately 10 miles east of the project area. At this site, the winds originate from the southwest to west-northwest nearly 42% of the time. The annual mean wind speed at the McClure Pass site is 4.5 miles per hour (mph).

Data from the current version of BLM Colorado's Annual Report (Annual Report 2.0) for Air Resources is incorporated by reference in this assessment to provide information for the affected environment and impacts analysis. The Annual Report 2.0 is available to the public on BLM Colorado's website at: https://www.blm.gov/programs/natural-resources/soil-air-water/air/colorado.

The following locations in the Annual Report 2.0 contain pertinent information about the Affected Environment:

(1) *Climate Statistics and Analysis* – This section of the report (Section 6.0 Climate Statistics and Analysis) describes Colorado's climate, as summarized from the Western Regional Climate Center's website. It also describes the science, metrics, and trends accounting for recent and projected climate change (based on potential future global emissions scenarios), as summarized from Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report and Special Report (SR15) (IPCC 2014). This section discusses the anticipated human health effects associated with current and projected climate change; and explores estimates of various downstream combustion-related emissions from various Federal and non-Federal contributors relative to total U.S. and global emissions trends, as well as the projected RCP scenario emissions used to model and predict the future climatic changes associated with such emissions.

- The "Greenhouse Gases" subsection provides an overview of GHGs and how they can potentially influence Climate Change.
- The "Colorado's Climate" and "Climate Change" subsections contain historical GHG and climate change information, including the following Colorado-specific information:
  - In Colorado, the statewide annual average temperatures have increased by 2.0°F and 2.5°F over the past 30 and 50 years, respectively. Scientists have observed warming trends over this period in most parts of the state and have shown that daily minimum temperatures have warmed more than daily maximum temperatures. Additionally, temperature increases have occurred in all seasons.
  - No long-term trends in average annual precipitation (30 to 50 years) have been detected across Colorado, although since 2000, the state has experienced below-average annual precipitation and snowpack. The warming trends have contributed to earlier (approximately 1 to 4 weeks) snowmelt and peak runoff in spring.

(2) *The "Carbon Budget"* – This subsection provides year 2018 GHG emissions data for Colorado and the U.S.

3.3.2 Oil and Gas Production and Greenhouse Gas Emissions – Global, U.S., and Colorado

According to data from the U.S. Department of the Interior, Office of Natural Resources Revenue (ONRR), the U.S. total Federal (onshore) oil and gas production in 2015 was approximately 191 million

barrels (bbl) of oil and 3,482,000 million cubic feet (MMcf) of natural gas, which accounted for 5.6% and 10.6% of the nation's total production (combined Federal and non-Federal), respectively (ONRR 2017). Colorado's Federal oil and gas production represented 0.66% and 13.7% of all Federal oil and gas production in 2015, and 0.15% and 2.0% of the U.S. total oil and gas production (combined Federal and non-Federal, onshore and offshore), respectively. BLM expects that the GHG emissions associated with future Federal oil and gas produced in Colorado will continue to comprise similar percentages of the total GHG emissions associated with future Federal and U.S. oil and gas production. For this analysis, the BLM makes the conservative assumption that all of the oil and gas produced in the U.S. is combusted within the larger sectors of the economy (electricity generation; transportation; industry).

The U.S. produced approximately 3,270 million tons of CO2e emissions in 2015 for oil- and gas-related activities, including processing and downstream combustion, according to EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks (EPA 2017). The calculated 2015 CO2e emissions from Federal oil and gas development and operations in Colorado (47.5 million tons) and across the nation (274 million tons onshore) represent 0.31% and 1.8 percent, respectively, of the U.S. total GHG emissions (BLM 2016). Note that the percentage of the 2015 U.S. total GHG emissions associated with U.S. oil- and gas development-related activities (upstream/midstream) is approximately 21.6 percent. In addition, Table 6-1 of Annual Report 2.0 provides year 2018 U.S total and Federal fossil fuel emissions. This table shows that in 2018, Colorado Federal natural gas production constituted about 15% of the total U.S. Federal natural gas production, and Colorado Federal petroleum production made up about 1% of total U.S. Federal petroleum production (BLM 2019).

According to the International Energy Agency (IEA), global energy-related CO2 emissions flattened in 2019 at around 33 metric gigatons (Gt), following 2 years of increases, while the U.S. saw its largest annual decline in energy-related CO2 emissions—a decrease of 140 MMt, or 2.9%, to 4.8 Gt (IEA 2020).

3.4 ENVIRONMENTAL EFFECTS

3.4.1 Proposed Action

Analytical Assumptions

End-use (downstream) combustion of oil and gas production from both projects would result in GHG emissions. For this assessment, the BLM uses EIA Annual Energy Outlook 30-year projections to estimate potential cumulative (total over 30-year period) downstream GHG emissions (EIA 2018). The projected downstream estimates in this assessment are based on EIA assumptions, including:

(1) While the potential end uses of produced oil and gas include transportation, heating, medicines, plastics, asphalt, and electricity generation, among others, for this analysis, all projected oil and gas production is assumed to be combusted, with no losses associated with product transmission and processing; and

(2) All produced oil goes to the transportation sector, and gas is split among the residential, commercial, and industrial sectors.

Applying these assumptions would likely result in an overestimate of downstream GHG emissions, as over the past decade, non-combustion consumption of fossil fuels has typically accounted for about 7% of total fossil fuel consumption and about 6% of total energy consumption in the United States, according to EIA data (https://www.eia.gov/todayinenergy/detail.php?id=35672).

Because GHGs accumulate in the atmosphere, and climate change impacts occur on a global scale, BLM has calculated 30-year projected estimates of downstream GHG emissions from consumption (i.e., combustion), based on estimates of projected volumes of produced oil and gas (see following section).

The projected emissions are based on oil and gas emissions inventories developed specifically for both projects, as detailed in the next section.

Inputs and Methodology

Total GHG emissions (tons of CO2e) were estimated for the downstream consumption (i.e., combustion) of potential oil and gas production that could occur from wells for both projects, as well as the combustion of all Federal and non-Federal oil and gas produced over 30 years within the management boundaries of the Uncompahgre Field Office (UFO), and all Federal and non-Federal oil and gas produced over 30 years within the State of Colorado. Several pieces of data and information were needed to make these calculations including well types, estimated first-year annual production rates for each well type, production profiles for each well type over an assumed 30-year life, number of wells of each type, and an estimate of greenhouse gas emissions generated by combustion of each resource (oil and gas). In order to put these calculated emissions into context, BLM also collected and developed information about cumulative oil and gas development activity and production across the UFO and Colorado. The following outlines the basis of the data and information obtained and used for this assessment.

(1) *New Well Counts and Development Rates*

- Bull Mountain Unit MDP (consistent with selected alternative)
  - 73 – new Federal coalbed methane (CBM) wells
  - 73 – new Federal conventional oil and gas wells targeting the Mancos shale
  - 28 – new private CBM wells
  - 27 – new private conventional oil and gas wells targeting the Mancos shale
- 5-Pad Project (consistent with selected alternative)
  - One new Federal CBM well
  - 24 – new Federal conventional oil and gas wells
- UFO and Colorado
  - Existing wells as of year 2015 from the Colorado Oil and Gas Conservation Commission (COGCC)
  - Future projected wells post-2015 from the BLM Colorado Air Resource Management Modeling Study (CARMMS 2.0) (BLM 2017a) for two future scenarios.
    - "High" scenario based on reasonably foreseeable development (RFD) for each BLM Colorado Field Office (UFO projection included both projects).
    - "Low" scenario based on future continuation of 5-year (2011-2015) average rate of new oil and gas development (UFO projection did not include BMUMDP or 5-Pad Project).

(2) *Projected Oil and Gas Production*

- First-year production profiles for project wells
  - CBM wells – first-year production estimate submitted to BLM by SG Interests, Inc. in support of APDs for new CBM wells within the Bull Mountain Unit. The first-year CBM production rate assumed for new future CBM wells for both projects: 288,000 thousand cubic feet per year (Mcf/yr) of gas per well.

- Conventional oil and gas wells – average first-year production rates originally developed for CARMMS 2.0 emissions inventories, based on hundreds of first-year production estimates for western Colorado wells (western Colorado well production data from COGCC). The assumed conventional well first-year production rates were 188,304 Mcf/yr of gas and 873 barrels per year (bbl/yr) of oil per well.
- All wells for both projects – 201 new wells (146 Federal and 55 private) for the BMUMDP, and 25 new wells (all Federal) for the 5-Pad project. All of these are assumed to be in their first year (i.e., maximum annual production) at the same time. The assumed total first year's production for all wells, by project:
  - Bull Mountain Unit MDP: 47,918,400 Mcf gas and 87,300 bbl oil
  - 5-Pad Project: 4,807,296 Mcf gas and 20,952 bbl oil

- First-year production profiles for wells in UFO and Colorado
  - First year production rates from COGCC for UFO and Colorado.
- Future production profiles
  - 30-year production decline curves (to account for aging wells) originally developed for CARMMS 2.0 for each well type (CBM or conventional) based on multiple years of COGCC production data for hundreds of western Colorado wells.
    - These empirically derived 30-year production decline curves are applied to new project wells and new wells projected for UFO and Colorado under the two development scenarios described in section (1).
    - The project-specific GHG emission calculations assume that all new project wells begin production at the same time and follow the production decline curves described above over a 30-year period.
    - GHG emission calculations for UFO and Colorado 30-year projected production account for the ages of existing wells (because existing wells are at different points in the 30-year decline profile) and assume a constant annual rate of new oil and gas development consistent with the two development scenarios described in section (1) (*i.e.*, all new UFO and Colorado wells are not assumed to start production in the same year).

(3) *Emissions Factors and Calculation Methodology*

- Calculations use 2018 Energy Information Administration (EIA) Annual Energy Outlook (EIA) 30-year (2020-2050) end-use oil and gas consumption and corresponding carbon dioxide equivalent (CO2e) emissions.
- Calculations of end-use combustion CO2e emissions for each project, and future projected UFO and Colorado oil and gas production, assume that any fraction of the EIA 30-year end-use oil and gas consumption estimate would result in the same fraction of its estimate of 30-year end-use related CO2e emissions. (For example, production equivalent to 10% of the total 30-year end-use consumption estimate would result in 10% of the 30-year end-use related CO2e emissions estimate).
- As discussed above, calculations assume that all future oil and gas production from both projects, UFO, and Colorado would be combusted, and none would be used in other end-uses such as manufactured products.

Combustion-Related GHG Emissions Estimates

Using the data, information, and methodology described above, BLM calculated the estimated emissions from combustion of peak (i.e., first-year) production of oil and gas to be 0.30 million metric tons (MMt) of CO2e for the 5-Pad Project and 2.95 MMt of CO2e for the BMUMDP. Natural gas is expected to make up the majority of the production from the two projects, and to account for approximately 98% of the total CO2e emissions from combustion of the produced oil and gas.

Table 1 provides 30-year projected production and combustion CO2e emissions totals for each project, and for UFO and Colorado "high" and "low" future production scenarios, based on the relative share of estimated total 30-year U.S. production.

Table 1. 30-year Projected Production and Associated Combustion-Related CO2e Emissions

		Estimated 30-year total production (bbl oil, Mcf gas)	Percent of U.S. estimated 30-year total production	30-year CO2e Emissions (MMt)	Total 30-year CO2e Emissions (oil + gas) (MMt)
Dual Operator 5-Pad Project	Oil Gas	84,067 23,265,898	0.000045 0.00403	0.03 1.41	1.44
Bull Mountain Unit MDP	Oil Gas	350,278 231,910,952	0.00019 0.0402	0.12 14.09	14.22
Uncompahgre Field Office (high)	Oil Gas	5,271,723 2,084,940,113	0.0028 0.36	1.85 126.71	128.56
Uncompahgre Field Office (low)	Oil Gas	234,825 126,655,679	0.00013 0.022	0.08 7.70	7.78
Colorado (high)	Oil Gas	5,560,906,794 89,556,518,253	2.97 15.51	1,952.53 5,442.50	7,395.03
Colorado (low)	Oil Gas	4,180,861,512 51,668,223,874	2.23 8.95	1,476.97 3,139.97	4,607.94

In order to provide a comprehensive estimate of the maximum total GHG emissions that could be released for both projects in a single year, maximum annual developmental and operational upstream and midstream GHG emissions that were described in the EA and EIS are incorporated here by reference and added to the estimated peak-year downstream combustion emissions described above.

Table 2. Estimated Maximum Annual CO2e Emissions

	Maximum Annual Upstream Construction / Development CO2e Emissions (MMt) [3]	Maximum Annual Upstream and Midstream Production CO2e Emissions (MMt) [3]	Maximum Annual Downstream Combustion CO2e Emissions (MMt)	Maximum Total Annual CO2e Emissions (MMt)
Dual Operator 5-Pad Project [1]	28,089	4,577	0.30	0.33
Bull Mountain Unit MDP [2]	7,107	37,282	2.95	2.99

[1] Dual Operator 5-Pad Proposal upstream CO2e emissions were estimated using GHG emission values provided in Tables 3-9 and 3-10 of the 5-Pad EA.

[2] BMUMDP upstream CO2e emissions were obtained from Table 4-13 of the BMUMDP EIS.

[3] Upstream CH_4 and N_2O emissions converted to CO2e using 20-year global warming potential (GWP) values.

The estimates in Table 2 could describe the maximum potential annual GHG emissions for each project; however, these likely are overestimates. Development-related engines used in the construction and production phases likely would use natural gas produced from the wells themselves. As a result, some emissions would be double counted in Table 2.

Cumulative Inventories and Climate Change

The following projected CO2e emissions and trends for Colorado, other states that produce Federal oil and gas, and the region of the world described by the IPCC as including the U.S. (R50ECD), are provided for comparison. These cumulative estimates would be expected to include the downstream combustion-related emissions for new oil and gas that could be produced by the BMUMDP and 5-pad projects (identified in Table 1), as well as the development-related emissions for the projects (see Table 2 for maximum annual estimates). The following discussion also compares the maximum total annual CO2e emissions values in Table 2 with year 2030 projected total Colorado Federal CO2e emissions resulting from natural gas production and end-use consumption.

- The 30-year (2020–2050) CO2e emission total for the region including the U.S. (R50ECD World Region) under the IPCC concentration pathway for smallest climate change scenario (RCP 2.6) is approximately 2.7 x 10^11 MMt. BLM's Greenhouse Gas and Climate Change Report (Golder 2017) includes estimates of cumulative GHG (CO2e) emissions associated with Federal and non-Federal onshore energy-related construction and production (i.e., upstream and midstream) and consumption (i.e., downstream) of oil, natural gas, and natural gas liquids for two future years and energy development scenarios ("high" and "normal" scenarios for years 2020 and 2030). The report used EIA production and consumption data to determine growth factors to estimate normal and high inventories. The "baseline" year in the report is 2014.

  Oil

  - Annual Colorado Federal emissions due to oil production and end-use consumption are projected to remain almost static from 2014 to future years 2020 and 2030, with a slight decrease in GHG emissions for both scenarios, from 2.22 MMt of CO2e in 2014, to 2.02 and 2.15 MMt of CO2e in the 2030 normal and high scenarios, respectively.
  - For the central and western states with Federal oil and gas managed by BLM (California, Colorado, Idaho, Kansas, Montana, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah and Wyoming), total annual Federal oil GHG emissions are projected to slightly decrease (–2 MMt of CO2e) from 2014 to 2030 for the normal scenario and slightly increase (+2 MMt of CO2e) for the high scenario. The year 2014 annual Federal oil GHG emissions total is approximately 68 MMt of CO2e.

  Natural Gas

  - Annual Colorado Federal emissions due to natural gas production and end-use consumption are projected to increase into year 2030 for both scenarios, from 42.91 MMt of carbon dioxide equivalents (MMt CO2e) in base year 2014 to 44.55 and 45.03 MMt of CO2e in the 2030 normal and high scenarios, respectively.
  - For the twelve states listed above, total annual Federal natural gas GHG emissions are projected to increase by almost 25% from 2014 to 2030 for both scenarios. The year 2014 annual Federal natural gas GHG emissions total is ~ 210 MMT of CO2e.
  - As noted above, end-use consumption emissions due to natural gas combustion constitute approximately 98% of the total end-use emission estimate for each project, and as shown in Table 2 above, annual end-use consumption emissions make up over 90% of the total maximum

annual GHG emissions for each project. In light of these percentages, the maximum total annual CO2e emissions for each project (Table 2) can be reasonably compared with the annual Federal natural gas combustion emission estimates (projected for year 2030) for Colorado and other states in the region. The most direct comparison is with Federal natural gas-related emissions in Colorado:

- The 5-pad maximum potential annual CO2e emissions would constitute approximately 0.74% of the annual projected year 2030 Colorado Federal emissions due to natural gas production and end-use emissions (under both the normal and high scenarios).
- The BMUMDP maximum potential annual CO2e emissions would constitute approximately 6.7% of the annual projected year 2030 Colorado Federal emissions due to natural gas production and end-use emissions (under both the normal and high scenarios).

Natural Gas Liquids

- Annual Colorado Federal emissions due to natural gas liquids production and end-use consumption are projected to decrease from baseline year 2014 to projected year 2030 by approximately 25 to 30% for both scenarios, from 2.20 MMt of CO2e in 2014, to 1.60 and 1.70 MMt of CO2e in the 2030 normal and high scenarios, respectively.
- For the twelve states listed above, total annual Federal natural gas liquids GHG emissions are also projected to decrease by 25 to 30% from 2014 to 2030 for both scenarios. The year 2014 annual Federal natural gas liquids GHG emissions total is approximately 22 MMt of CO2e.

BLM incorporates here by reference related subsections of the most recent Annual Report 2.0 ("Emissions Analysis," "Projected Climate Change Impacts," "NEPA Analysis," and "The Carbon Budget") for further description of potential cumulative emissions and climate changes. The "Projected Climate Change Impacts" section of the report explains that all climate model projections indicate future warming in Colorado. Statewide average annual temperatures are projected to warm by less than +2.0 °F and increase +2.5°F to +5°F by 2050, relative to a 1971–2000 historical average under the RCP 2.6 and 4.5 scenarios, respectively. Under the IPCC's high global GHG emissions scenario (RCP 8.5), the projected warming is +3.5°F to +6.5°F and would occur later in the century, as the RCP scenarios diverge rapidly after mid-century (note that the average temperature for the RCP 2.6 scenario is projected to remain almost static for the second half of the 21st century).

Summer temperatures are projected to warm slightly more than winter temperatures, with maximums similar to the hottest summers that have occurred in the past 100 years. Precipitation projections for the U.S. are less clear, as the climate models consistently project an increase in annual precipitation for the northernmost states of the U.S., and a decrease in precipitation for the far Southwest, with individual models showing a range of changes by 2050, such as –2.5% to +2.5% for RCP 2.6, –5% to +6% for RCP 4.5, and –3% to +8% under RCP 8.5. Nearly all of the models predict an increase in winter precipitation by 2050, although most projections of snowpack (snow water equivalent [SWE] as of April 1) show declines by mid-century due to the projected warming. Late-summer flows are projected to decrease as the peak shifts earlier in the season, although the changes in the timing of runoff are more certain than changes in the amount of runoff. In general, the majority of published research indicates a tendency towards future decreases in annual streamflow for all of Colorado's river basins. Increased warming, drought, and insect outbreaks, all caused by or linked to climate change, are expected to continue to increase wildfire risks and impacts to people and ecosystems.

The Annual Report 2.0 estimates that consuming all of the Federal energy produced in the U.S. in 2018 (onshore and offshore) would be equivalent to 0.22% of the remaining carbon budget, while the Colorado component of the Federal mineral estate is approximately 0.01% of the carbon budget and just 1.02% of

total U.S. fossil fuel energy emissions (as CO2e) on an annual basis. At the current production rates shown, total Federal mineral combustion, in isolation, would exhaust the carbon budget in approximately 461 years, while combustion of all Federal minerals in Colorado would do the same in about 9,943 years.

On a global scale, the GHG emission contribution of any single geographic subunit (such as a Field Office or project area) or source (such as Federal minerals) on a subnational scale is dwarfed by the large number of comparable national and subnational contributors. The relative contribution of GHG emissions from production and consumption of Federal minerals will vary depending on contemporaneous changes in other sources of GHG emissions. A single subnational contributor, such as a BLM field office, is very unlikely to influence global cumulative emissions. Nevertheless, each source contributes, on a relative basis, to global emissions and long-term climate impacts.

Potential Future Mitigation

Many regulations and incentives affect downstream emission sources (vehicle fuel efficiency requirements, etc.), and the BLM does not have authority over these indirect sources. The BLM requires activities that it authorizes to comply with applicable state, tribal, and Federal pollution control laws, in accordance with FLPMA. Federal oil-and-gas-related GHG emissions in Colorado are expected to follow national emission pathways and trends, and Colorado state regulations are expected to reduce Colorado-based emissions more than in other states.

In May 2019, the State of Colorado enacted HB 19-1261, which sets statewide GHG emission reduction goals (year 2025 GHG emissions are to be 26% lower than the year 2005 level, and year 2050 GHG emissions are to be a maximum of 10% of the year 2005 level). The statute directs the Colorado Air Quality Control Commission to promulgate regulations to achieve these goals. Such reductions, if achieved, may change the cumulative impacts of emissions resulting from BLM decisions. The BLM will continue to evaluate emission trends in its future decision-making.

The BLM will continue to require that operators follow best management practices and control or offset GHG emissions by using feasible techniques such as minimizing vegetation clearing, maximizing successful interim reclamation, reducing truck idling, and improving equipment to minimize fugitive emissions, consistent with state and Federal requirements.

3.4.2 No Action Alternative

As described in section 2.1.2, the No Action Alternative would negate BLM's decisions to approve the two projects. However, potential GHG emissions and climate change impacts for both the No Action and Proposed Action alternatives would be similar, as the difference between future potential downstream GHG emissions associated with new oil and gas production from the projects, and emissions under the No Action alternative, would likely be small when compared to broader scope GHG emissions inventories (U.S. and Global).

To examine how BLM Colorado decisions for Federal minerals translate into free energy market dynamics and potential climate-related impacts, the BLM evaluated Federal mineral development in Colorado using the Bureau of Ocean Energy Management (BOEM) Market Simulation Model (MarketSim). MarketSim models oil, gas, coal, and electricity markets to produce estimates of the substitute energy source mix from production changes expected under various resource-restricted scenarios. The model provides net substitution assessments for oil and gas imports, onshore oil and gas production, fuel switching (e.g., coal), and reduced energy consumption (demand) for a given period of time. Although BOEM developed MarketSim to produce substitution estimates specifically for the absence of a new Outer Continental Shelf (OCS) leasing program, the basic model calculations allow for its use in modeling the substitutes for other oil and gas sources, including new onshore production.

Future energy market projection models such as MarketSim require a large amount of input about future global energy demand and production, and long-term modeling applications are subject to uncertainty about future global trends and societal behaviors (such as competition among countries and regulatory changes in response to climate change). BLM's application of MarketSim predicts changes in the energy market through year 2025, and due to this relatively short time scale, assumes that the modeling inputs adequately represent near future global market trends and values. For additional details on MarketSim, please refer to the full model documentation entitled "Consumer Surplus and Energy Substitutes for OCS Oil and Gas Production: The 2017 Revised Market Simulation Model (MarketSim)," which is available online at https://www.boem.gov/ESPIS/5/5612.pdf.

BLM Colorado used MarketSim to estimate the effects of a statewide Federal "No Development" scenario (i.e., no new Federal mineral production) at the broader market scales, for the years 2019 through 2025 (the remainder of the CARMMS 2.0 projection period), at both the low (current trend) and high (RFD scenario) development rates. The results for the low scenario predict that 71.3% of the eliminated Federal mineral production would be offset by additional onshore production, 18.2% by increased foreign imports, 8.3% by decreased demand, and the remainder (2.2%) by increases in coal and other electricity (nuclear, hydro, solar, wind, etc.) markets. The high scenario produced similar results, albeit with a slightly higher shift in demand (decreased consumption) substitution at 8.7%.

BOEM also developed a lifecycle model to estimate the GHGs associated with the MarketSim substitution results. The GHG estimates include emissions from oil and gas refining, processing, storage, consumption, and substitution. These calculations are not specific to the consumption of OCS production and are thus appropriate to use for calculating GHG emissions from the consumption of oil and gas from Colorado Federal minerals. The full model documentation is titled "OCS Oil and Natural Gas: Potential Lifecycle Greenhouse Gas Emissions and Social Cost of Carbon," and is available online at https://www.boem.gov/ocs-oil-and-natural-gas/.

In absolute terms, the MarketSim predicts that under the statewide Federal "No Development" scenario, emissions associated with substitute sources would equate to approximately 91% of the Colorado Federal oil and gas GHG emissions (as CO2e) associated with both the low and high development scenarios. This result can be extrapolated to future GHG emission estimates for smaller areas or groups of oil and gas wells in Colorado, including new oil and gas wells for both projects. Thus, based on the model, BLM would expect that approximately 91% of the future GHG emissions (including those associated with downstream combustion) estimated for oil and gas production from both projects would be generated from substitute sources under the No Action Alternative. Potential GHG emissions and climate change impacts for both alternatives therefore would be expected to be similar, and the emissions under both alternatives are small in comparison to broader scope GHG emissions inventories (U.S., regional, global).

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